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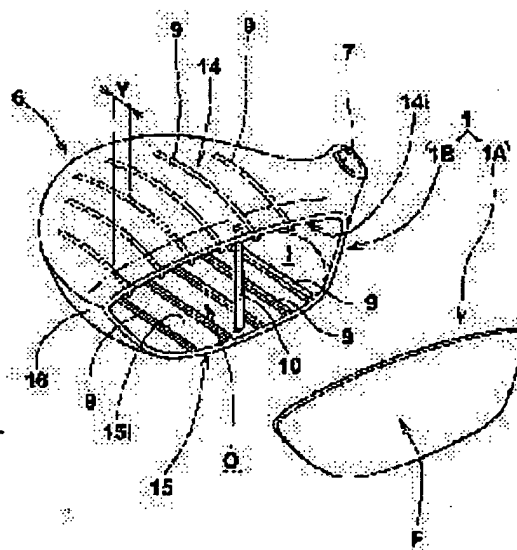
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### (54) GOLF CLUB HEAD AND ITS MANUFACTURING METHOD

#### (57)Abstract:

**PROBLEM TO BE SOLVED:** To improve sound of hitting balls, and to increase stability in size.

**SOLUTION:** A golf club head 1 comprises a face member 1A and a body 1B of the head with an opening O having the face member 1A at the front. The body 1B of the head is made of cast incorporating, at least, a crown shell 14, a sole shell 15, and a side shell 16. A plurality of linear protrusions 9 raised from inner surfaces and extending in a direction perpendicular to a face surface are provided on an inner surface 14i of the crown shell 14 and/or an inner surface 14i of the sole shell 15. A reinforcing rib 10 which is tensioned between the inner surfaces of the body 1B of the head to prevent deformation of the opening O or a removed mark where the reinforcing rib is removed is provided near the opening O.



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DETAILED DESCRIPTION

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## [Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the golf club head which improves a hit ball sound and may improve dimensional stability, and its manufacture approach.

[0002]

[Description of the Prior Art] For example, the golf club head of a wood mold has a thing in use using a metallic material with high specific strength, such as stainless steel and a titanium alloy, in recent years. Compared with the persimmon head which used the timber of the conventional persimmon, the degree of freedom of a weight-distribution design is high, and such a metal golf club head can aim at easily buildup of moment of inertia or center-of-gravity depth. thereby, even when the hit ball of the heart is removed and carried out, a metal golf club head is stopped to the minimum, compared with a persimmon head, the ease of striking is markedly alike and blurring of the directivity of hit ball and its lowering of flight distance are improving.

[0003]

[Problem(s) to be Solved by the Invention] However, generally, in the hit ball sound of a persimmon head, for the familiar golfer, it was insipidly audible, and, as for the hit ball sound of a metal golf club head, an improvement of a ball sound was desired from sometime past.

[0004] Then, the technique (for example, JP,10-33724,A) of performing two or more steps of predetermined heat treatments to the face plate which carries out the hit ball of the ball in order to improve the hit ball sound of a metal golf club head, the technique of arranging a tuning fork with a complicated configuration etc. on the centrum of a head etc. are known. However, by the former approach, a complicated heat treatment process must be performed, and there is nonconformity that mounting and shaping of the tuning fork inside a head etc. become difficult, by the latter approach, and there is a problem that all reduce the productivity of a head sharply.

[0005] Moreover, in recent years, as shown in drawing 15, the head d of 2 piece structures constituted by the head body c which has the opening O which allots the face member b and this face member b to a front face, and moreover consists of a cast is becoming in use. While the ingredient excellent in the resilience is used for the face member b, a for such a head d, the metallic material with which the head body c usually fitted ROSUTO wax precision casting is used.

[0006] When fabricating said head body c by casting, it is necessary to manufacture first this head body c and the wax model which makes the same configuration substantially. However, since the wax model which has the shape of the above head bodies c and isomorphism has said opening O in a face section side, its reinforcement is comparatively low and it is easy to deform by the external force which acts during contraction of the wax by the passage of time, or handling. The head volume is especially 3 250cm. With the large-sized head which exceeds, since the thickness of the crown section and the SOL section is set up very thinly, deformation of crown -- opening of the wax model is crushed -- and the direction of a SOL (the vertical direction) tends to become large. If mold is manufactured using such a wax model, the head which a design dimension is large and was widely different will be manufactured, and it will become difficult to supply the head stabilized dimensionally.

[0007] think out this invention in view of the two above troubles -- two or more lines extended to the sense which is upheaves from this inner surface to the inner surface of a head body, and carries out an abbreviation rectangular cross with the face section -- with a projection It is based on having the excision marks which excised at least one reinforcement

rib which stretches between the inner surfaces of a head body near the opening by the side of the face section, and prevents deformation of this opening, or this reinforcing rib. It aims at offering the golf club head which improves a ball sound comfortably, without reducing productivity, and is excellent in dimensional stability. Moreover, it aims at offering the manufacture approach of a golf club head that the golf club head which was excellent in such a hit ball sound, and was moreover excellent in dimensional stability can be manufactured.

[0008]

[Means for Solving the Problem] Invention according to claim 1 consists of a face member and a head body which has an opening which allots this face member to a front face among this inventions. It is a metal golf club head with a centrum to the interior. And said head body The crown shell which makes a head top face, and the SOL shell which makes a head base, It consists of a cast which equipped one with the side shell which inherits between said crown shells and SOL shells at least. It has a projection. and two or more lines extended to the sense which upheaves from this inner surface to the inner surface of said head body, and carries out an abbreviation rectangular cross with a face side -- And it is characterized by having the excision marks which excised at least one reinforcing rib which stretches between the inner surfaces of a head body near said opening, and prevents deformation of this opening, or this reinforcing rib.

[0009] moreover, invention according to claim 2 -- said line -- a projection is a golf club head according to claim 1 characterized by being prepared in the inner surface of a crown shell, and/or the inner surface of said SOL shell.

[0010] Moreover, invention according to claim 3 is a golf club head according to claim 1 or 2 characterized by the thickness of said crown shell or said SOL shell being 0.6-1.2mm.

[0011] moreover, invention according to claim 4 -- said line -- the whole projection product -- 400-1200mm<sup>3</sup> it is -- is the golf club head according to claim 1 to 3 characterized by things.

[0012] moreover, at least two long picture lines whose die length which invention according to claim 5 adjoins said crown shell and a SOL shell, and is extended is 42-75mm -- it is the golf club head according to claim 1 to 4 characterized by forming the projection, respectively.

[0013] Moreover, invention according to claim 6 consists of a face member and a head body which has opening which allots this face member to a front face. And the wax model forming cycle which is the manufacture approach of a golf club head of manufacturing a metal golf club head with a centrum inside, and fabricates the wax model for casting said head body, While including the casting which forms said wax model and the mold which has an isomorphism-like shaping cavity, and casts said head body with this mold, said wax model The crown shell model which makes a head top face, and the SOL shell model which makes a head base, In preparation for one, it has opening for the side shell model which inherits between said crown shell model and SOL shell models in a front face. It has a projection mode and two or more lines extended with the sense which upheaves from this inner surface to the inner surface of said wax model, and carries out an abbreviation rectangular cross with a face side -- And it is characterized by having at least one reinforcing rib model which stretches between the inner surfaces of this wax model near said opening, and prevents deformation of this opening.

[0014]

[Embodiment of the Invention] Hereafter, one gestalt of operation of this invention is explained based on a drawing. drawing 1, the perspective view of the golf club head (it may only be hereafter called a "head") 1 of the wood mold an operation gestalt of this invention and drawing 2 show the top view, and drawing 3 shows the decomposition perspective view, respectively.

[0015] The face section 2 which has the face side F where the head 1 of this operation gestalt carries out the hit ball on the ball in drawing, The crown section 3 which stands in a row in upper limb 2a of this face section 2, and makes a head top face, The SOL section 4 which stands in a row in margo-inferior (leading edge) 2b of said face section 2, and makes a head base, It has the side section 5 extended very much from tow side edge 2c of the splice face section 2 to of heel side edges of the face section 2 through the back face section 6 in between said crown sections 3 and SOL sections 4, and Centrum i (refer to drawing 3) is formed in the interior. Moreover, near the intersection section by the side of the heel of the face section 2, the crown section 3, and the side section 5, the shaft mounting section 7 which end of a shaft is inserted and fixes is formed.

[0016] Moreover, as shown in drawing 3, the head 1 consisted of head body 1B which has the opening O which allots face member 1A and this face member 1A to a front face, and consists of a cast, and has illustrated 2 so-called piece structures in this example. It is useful to offer of an accurate head in order for the head 1 of such 2 piece structures to reduce a welding part as compared with the thing of 3 piece structures, to reduce routings, and to improve productivity.

and also to be useful to controlling many dimensions of a head, the variation of many include angles, etc.

[0017] Said face member 1A fixes tabular by welding to the edge of nothing and said opening O in this example. As face member 1A, it can form with various kinds of metallic materials, such as an aluminium alloy, titanium, a titanium alloy, and stainless steel, and a titanium alloy is adopted in this example. Especially the method of processing face member 1A is not limited. In addition, although not illustrated, face member 1A can also be constituted from the shape of a bowl, and a cross-section KO character which equipped one with face 1A who forms the face side and the extension extended from the periphery to head back, in addition various configurations can be used for it if needed.

[0018] Said head body 1B consists of a cast which equipped one with the side shell 16 which makes a splice and the perimeter of a head for between the crown shell 14 of the crown section 3 which twists all, carries out and makes the body, the SOL shell 15 of the SOL section 4 which twists all, carries out and makes the body, and said crown shells and the SOL base sections 15 in this example, and said shaft mounting section 7. Moreover, head body 1B has the opening O matched for a front face with said face member 1A. The head 1 of this example is the head volume 200-500cm<sup>3</sup> Since it has enlarged to extent, what made each of each thickness of the crown shell 14 and the SOL shell 15 the small thickness of 0.8-1.2mm is illustrated. In addition, the thickness of the side shell 16 is formed by about 0.8-1.2mm.

[0019] Moreover, head body 1B is formed with various kinds of metallic materials of an aluminium alloy, a titanium alloy, stainless steel, etc. which can be cast. A titanium alloy (Ti-6aluminum-4V) is adopted suitably, and said each p is really fabricated by ROSUTO wax precision casting. Such head body 1B can fabricate the shaft mounting section with a sufficient precision to the SOL shell 15, and is useful to improving dimensional accuracy, such as reducing the variation in a rye angle. However, head body 1B is not limited to the mode of a graphic display, can use the shaft mounting section 7 as another object, for example, can also be post-installed.

[0020] moreover, two or more lines extended to the sense which head body 1B of this operation gestalt upheaves from each inner surfaces 14i and 15i as an inner surface of head body 1B to inner surface 14i of the crown shell 14 which attends Centrum i, and inner surface 15i of the SOL shell 15, and carries out an abbreviation rectangular cross with a face side F -- that in which projection 9 -- was formed is shown. Moreover, what has the reinforcing rib 10 which stretches head body 1B between the inner surface near the opening O, and prevents deformation of this opening O is illustrated.

[0021] In advance of explanation of the operation by the above-mentioned configuration of head body 1B, the manufacture approach of head body 1B is explained first. Head body 1B passes with the casting which forms the wax model forming cycle which fabricates the wax model for casting this head body 1B, and this wax model and the mold which has an isomorphism-like shaping cavity, and casts said head body 1B with this mold, and is manufactured.

[0022] An example of the wax model 20 for casting head body 1B is shown in drawing 4. It injection molds with the mold and the wax model 20 equips one with the side shell model 23 which inherits between the crown shell model 2 on the top face of head which twists all and is equivalent to the body of *Perilla frutescens* (L.) Britton var. *crispa* (Thunb.) Decne., the SOL shell model 22 at the base of head which twists all and is equivalent to the body of *Perilla frutescens* (L.) Britton var. *crispa* (Thunb.) Decne., and said crown shell models 21 and the SOL shell models 22. Moreover, in this example, what equips the intersection section by the side of the heel of the crown shell model 21, the SOL shell model 22, and the side shell model 23 with the shaft spigot section model 24 at one is illustrated.

[0023] Moreover, the wax model 20 has the comparatively big opening O which leads to the front face which becomes a face side side inside. The wax model 20 which has such opening O deforms, after reinforcement tends to fall and injection molding it as conjointly generally as being a large-sized head, and that of \*\*\*\* is as above-mentioned. For this reason, two or more lines extended with the sense which upheaves from each inner surfaces 21i and 22i to inner surface 21i of the crown shell model 21, and inner surface 22i of the SOL shell model 22, and carries out an abbreviation rectangular cross with a face side -- the projection model 25 is formed. such a line -- the projection model 25 raises the flexural rigidity of the crown shell model 21 or the SOL shell model 22 etc., and can control deformation of each part

[0024] Furthermore, the reinforcing rib model 26 which stretches the wax model 20 between the inner surfaces of the wax model 20 near said opening O, and prevents deformation of this opening O is formed. For this reason, overall deformation of the wax model 20 after injection molding was carried out, and deformation of near division opening is suppressed very small. thus -- this example -- a line -- it is useful to raising the overall rigidity of the wax model 20 with sufficient balance, and reducing substantially the deformation each shell models 21 and 22 thru/or near opening

by the synergism of the projection model 25 and the reinforcing rib model 26. In addition, although not illustrated, the gate formation section for forming the gate etc. may be suitably attached to the wax model 20.

[0025] Moreover, the wax model 20 is formed in one in said configuration by injection molding a wax in metal mold however -- for example, it is shown in drawing 5 -- as -- a line, while fabricating body section of wax model 20A which does not have the projection model 25 and/or the reinforcing rib model 26 with the 1st metal mold (graphic display abbreviation) the 2nd metal mold (graphic display abbreviation) -- a line -- said wax model 20 can also be formed by another fabricating the projection model 25 and/or the reinforcing rib model 26, and fixing these with means, such as heat joining, to the inner surface of said body section of wax model 20A. Thus, the approach of fabricating the wax model 20 can be chosen variously if needed.

[0026] Moreover, the mold material g which consists of a fireproof ingredient of the shape of a slurry used as the raw material of mold and coarser sand granules (stucco) is made to adhere to the front face of said wax model 20 in a casting, as shown in drawing 6 (A). And while drying and solidifying the mold material g in Oven h etc., the internal wax model 20 is made eluted to the exterior with heating (dewaxing). The mold M which has the shaping cavity i1 f the space which the wax model 20 occupied inside by this can be manufactured. In addition, sign i2 is the gate.

[0027] And as shown in this drawing (B), after slushing molten metal k into Mold M and making it solidify, head body 1B can be taken out by grinding this mold M with a hammer etc., as shown in this drawing (C). thus, in this invention by using the mold M with which deformation once it was fabricated was dramatically formed based on the few fence prevention \*\*\*\* wax model 20, head body 1B very near a design dimension can be cast, and the variation in a dimension can be reduced substantially.

[0028] In order to heighten above-mentioned effectiveness, as shown in drawing 3, as for said reinforcing rib model (or it is the reinforcing rib 10 of head base 1B, and is below the same), it is desirable to prepare in the less than 3mm field Y more preferably less than 5mm from the edge of the opening O of head body 1B at the back face section 6 side and to prepare in the edge section of Opening O preferably especially. By this, deformation of Opening O can be controlled more effectively. In addition, although the reinforcing rib 10 remains immediately after casting head body 1B, since head body 1B which consists of a metallic material is equipped with sufficient rigidity unlike a wax model may excise this reinforcing rib 10 in advance of junction to face member 1A. In this case, lightweight-ization of a head etc. is attained and a design degree of freedom may be improved. In addition, when the reinforcing rib 10 is formed in said field Y, it is desirable also at the point that excision can be performed well.

[0029] The reinforcing rib model section 25 of this operation gestalt illustrates the thing of the shape of a column stretched up and down between each inner surface 21i of the crown shell model 21 and the SOL shell model 22, and 22i. The wax model 20 is easy to deform with the traditional head configuration besides the effect of thinning and Opening O in the direction of a crown-SOL. Then, rigid reinforcement of the wax model 20 can be effectively made considering as said mode. In addition, of course, it is also possible to form the reinforcing rib model 25 (graphic display abbreviation) which is extended horizontally and stretches between the inner surface by the side of the tow of the side shell 16 and the inner surfaces by the side of a heel.

[0030] moreover -- although especially definition is not carried out for the reinforcing rib model 25 -- the direction of prop, and the right-angled cross section -- 2-25mm<sup>2</sup> [ for example, ] -- more -- desirable -- 4-9mm<sup>2</sup> it is -- things are desirable. The cross-sectional area of the reinforcing rib model section 25 is 2 2mm. It becomes easy for the reinforcement effectiveness which bars deformation of the opening O of the wax model 20 as it is the following to face and is 2 25mm to reverse. In exceeding, it remains in a big configuration in head base 1B, and head weight is made in size and there is an inclination for excision to take time and effort. In addition, although said cross-sectional area is a thing per one when the number of the reinforcing rib models 25 is one, in the case of two or more, let it be the cross-sectional area of these sum totals. Moreover, a rectangle thru/or a square cross section are more suitable for a cross-section configuration than the viewpoint of a moldability.

[0031] Moreover, especially an arrangement number, an arrangement configuration, etc. of the reinforcing rib model can be carried out in various modes, without being limited. Drawing 7 (A) As are shown in - (C), and shown in drawing 8 (A) - (C) besides the shape of the shape of the shape of an II character, and an N character, and H character, various modes, such as the shape of the shape of the shape of a reverse N character and W character and a cross joint, are included at least. The shape of the shape of the shape of H character and a reverse N character and W character is more suitably desirable.

[0032] moreover, the line formed in cast head body 1B as a result of various experiments of artificers -- it became clear

that projection 9 had the also unexpectedly big effectiveness to an improvement of a hit ball sound. it is shown in drawing 9 -- as -- said inner surface 14i or 15i -- a line -- the line which adjoins each other when the two or more projection 9 is formed -- projections 9 and 9 -- this -- a line -- the groove air column tubular section B inserted by projection 9 is formed. And it generating columnar resonance (drawing 9 showing the secondary thing) within this a column tubular section B using a projection wall surface, in case an oscillation of the air produced in Centrum i by the impact at the time of a hit ball passes this air column tubular section B, and it being echoed for a long time and making it go across the reverberation sound at the time of a hit ball understood. And when artificers repeated various equipment monitor tests, it became clear that many golfers sensed comfort for the hit ball sound which contains the reverberation sound which reverberates after carrying out a hit ball for a long time. thus, the line of this invention -- projection 9 produces resonance, interference, etc. positively within Centrum i at the time of a hit ball, and can improve a hit ball sound comfortably.

[0033] said line -- as for projection 9, it is desirable to be extended to the sense which carries out an abbreviation rectangular cross with the face side F. At the time of a hit ball, aerial vibration is transmitted toward the back face section 6 from the face side F. for this reason, the sense which carries out an abbreviation rectangular cross with the face side F -- meeting -- a line -- the air which vibrated in the air column tubular section B can be effectively drawn forming projection 9. moreover, the line extended with such sense -- the line for forming a projection -- the projection model 25 can also reinforce the crown shell model 14 of the wax model 20, and the SOL shell model 15 effectively. addition, a vertical plane right-angled to the face side F and a line -- as for the include angle by the side of the acute angle to pinch [ a projection's 9 ], it is desirable that it is 20 or less degrees.

[0034] Moreover, the A-A line enlarged section of drawing 2 is shown in drawing 10. said line -- projection 9 has the inclination for the mesomeric effect by said air column tubular section B to fall if the projection height H is too small and when the projection width W is too small, it has the inclination for casting shaping to become [ the rigid reinforcement effectiveness ] small difficult. moreover, a line -- if the projection width W of projection 9 or projection height H is too large, it will be easy to bring about the increment in weight with a steep head. such a viewpoint -- a line -- although especially the projection width W of projection 9 is not necessarily limited, as for \*\*\*\*\*, it is more desirable to be referred to as 1.0-2.0mm 0.5-3.0mm, and it is more preferably desirable [ said projection height H ] in one combination of said projection width W that it is 0.5-3.0mm 0.3-5.0mm, for example. This operation gestalt shows what was formed in almost fixed projection width and projection height. more -- desirable -- a line -- as for projection height H of projection 9, it is desirable to consider as about 0.5 to 3.0 times of the thickness of the crown shell 14.

[0035] moreover, said line -- if the arrangement pitch P which is the distance between projection center line 9C and 9 is too too small, although based also on the arrangement number, the rigidity of the crown shell 14 or the SOL shell 1 will be easy to be raised remarkably, the sound pressure level of a hit ball sound itself will fall, and also the frequency of a reverberation sound becomes high too much, and projection 9 tends to approach the bad sound of a feeling. conversely, a line -- if the arrangement pitch P of projection 9 is too too large, and also the frequency of a reverberation sound will become low too much and it will be easy to approach the bad sound of a feeling -- a line -- the arrangement number of projection 9 will be restricted and there is an inclination which resonance stops being able to produce easily such a viewpoint -- a line -- although said especially arrangement pitch P of projection 9 is not limited, it is more preferably desirable [ the pitch ] to be referred to as 3.0-12.0mm still more preferably 3.0-15.0mm 0.85-15.0mm, for example.

[0036] moreover, a line -- what formed the point by semicircle arc whose diameter is almost equal to the projection width W as the cross-section configuration of projection 9 was shown in drawing 10 and the corner of a rectangle cross section was shown in drawing 11 (A) besides [ which was beveled with radii ] the shape of a rectangle -- as further shown in drawing 11 R> 1 (B), various configurations, such as an abbreviation triangle-like thing, are employable. On the occasion of casting, the good thing of fluidity of these cross-section configurations is more preferably desirable. [0037] in addition, a line -- although especially the number of projection 9 is not what is limited -- inner surface 14i of the crown shell 14, or inner surface 15i of the SOL shell 15 -- for example, it is [ 2-10 ] desirable to form about 5-10 more preferably at the point of prolonging the reinforcement effectiveness and the reverberation sound of the wax model 20.

[0038] moreover, all the lines formed in the inner surface of a head 1 -- the line which is total of the volume of projection 9 -- the steep increment in weight of a head 1 being caused if the whole projection 9 product V is too large or the case where the arrangement pitch P cannot but become remarkably small -- it is -- reverse -- a line -- if the wh

projection product V is too small -- each -- a line -- the die length of projection 9, the projection width W, projection height H, or a number serves as smallness, and there is an inclination for the effectiveness of producing resonance to fall. such a viewpoint -- a line -- the whole projection product V -- 400-1200mm<sup>3</sup> [ for example, ] -- more -- desirable -- 500-1000mm<sup>3</sup> \*\* -- carrying out is desirable.

[0039] Moreover, about much more improvement in a hit ball sound, the knowledge that it was effective sounding 4500-8000Hz for a long time [ emphasize more the reverberation sound of a 5000-6300Hz frequency band preferably especially, and ] was acquired as a result of the further experiment of artificers. When generally generated with air column tubing which opened ends, the n-th vibration frequency f is expressed with a degree type (1).  

$$f = C/n/2, \text{ and } L \text{ -- (1)}$$

Here, C is [ the degree of an oscillation and L of acoustic velocity and n ] the die length of air column tubing.

[0040] When its attention is paid to the secondary vibration frequency with high sound pressure energy, in order for vibration frequency f to serve as a frequency band which is 4500-8000Hz, the above-mentioned formula (1) shows the die-length L of air column tubing is 42-75mm. an adjacent line -- it has become clear that the almost same relation as the above-mentioned formula (1) is materialized also about said air column tube part B which projections 9 and 9 for for this reason, it is shown in drawing 2 -- as -- the line of this example -- the line of at least two long pictures whose die-length L which adjoins projection 9 and is extended is 42-75mm -- projections 30 and 30 are included. The desirable air column tubular section B is formed by this, and the reverberation sound in the frequency band which is 4500-8000Hz can be produced effectively.

[0041] moreover, a line -- projection 9 is equipped with edge 9A by the side of the face section, and edge 9B by the side of the back face section as shown in drawing 12 which is the B-B line sectional view of drawing 2. Especially the location of each of these edges 9A and 9B is not limited, but can be established in various locations. this example -- line -- edge 9A by the side of the face section of projection 9 is formed in the location which approached mostly inner surface 2i of the face section 2. Air which vibrated in the face section 2 thereby more effectively can be incorporated and made into the air column tubular section B.

[0042] moreover, inner surface 3i of the crown section 3 -- setting -- a line -- edge 9B by the side of the back face section of projection 9 is formed in the near side which cut down horizontal distance S1 from the upper intersection section 19 which the crown section 3 and the side section 5 cross. This is for reducing the poor injection molding at the time of creating a wax model. Said distance S1 has that desirable of \*\* more preferably set to 5-15mm 5mm or more for example.

[0043] As drawing 12 and the face section 2 of a head 1 are shown in drawing 13 which is the exploded view obtained from the inner surface side, moreover, the face section 2 of this example by 2.5-3.5mm, thickness T1 is annular to the perimeter of face center-section 2A of abbreviation fixed thickness, and this face center-section 2A, and is formed in and it has face thin-walled part 2B which width GW is 3-5mm, and thickness T2 made 0.3-0.7mm smallness rather than the thickness T1 of said face center-section 2A. Thus, it becomes possible by forming face thin-walled part 2B on thin meat in the perimeter of heavy-gage face center-section 2A to sound a reverberation sound for a long time by suppressing a periodic-damping operation of this face section 2 that vibrates most greatly, and vibrating the face section 2 for a long time at the time of a hit ball.

[0044] In addition, when the thickness T1 of said face center-section 2A is less than 2.5mm, the endurance of the face section 2 tends to fall, and the bending property of the face section 2 is spoiled by reverse in 3.5mm, and it becomes easy for the resilience ability to a ball to fall. It is desirable to set said thickness T1 to 2.6-3.0mm preferably especially. Moreover, it is desirable more preferably especially to set the difference of the thickness T1 of face center-section 2A and the thickness T2 of said face thin-walled part 2B to 0.3-0.5mm. Moreover, although this example shows the head which excised the reinforcing rib 10 from the head body, when not excising, it is suitable to allot so, that inner surface 2i of the face section 2 and a reinforcing rib 10 may not contact at the time of a hit ball.

[0045] Although this invention is applicable to various heads, it is the following modes that it is especially desirable. for example, the head volume -- 200-500cm<sup>3</sup> -- more -- desirable -- 250-450cm<sup>3</sup> Applying to the large-sized head of extent is effective. The head volume is 3 200cm. Since the thing of the following has the comparatively high rigidity the wax model, even if this invention is not used for it, it is for being easy to stop the deformation of a wax model small, and it is 3 500cm to reverse. In what is exceeded, in case head body 1B is cast, it is easy to produce poor castings by thinning.

[0046] moreover, this invention -- the opening area of said opening O of head body 1B -- desirable -- 20-80cm<sup>2</sup> -- m



-- desirable -- 25-75cm<sup>2</sup> Applying to the head which makes extent is effective. the opening area of said opening O -- 20cm<sup>2</sup> \*\* of the following -- \*\*\*\* -- since the rigidity of a wax model is comparatively high and it is easy to stop the deformation of this wax model small -- it is -- reverse -- 80cm<sup>2</sup> The head body which exceeds is for being easy to produce poor molding in current foundry technique. Moreover, as for the same meaning as said opening area to this invention, it is effective that the greatest height of the vertical direction of said opening O of head body 1B is desirable and 30-85mm and the greatest more desirable horizontal width of about 40-70mm and Opening O apply to a 50-110mm head more preferably 45-120mm.

[0047] Although the golf club head of a wood mold was mentioned as the example and explained in full detail about the operation gestalt of this invention above, if this invention is a metal head which has a centrum, it is applicable to head of an iron mold, a putter mold, and the utility mold that has the in-between configuration of a wood mold and a iron mold further etc. moreover -- the above-mentioned operation gestalt -- each inner surfaces 14i and 15i of the cro shell 14 and the SOL shell 15 -- a line -- although the thing in which the projection 9 was formed was illustrated -- o of inner surfaces -- a line -- it is possible to form projection 9. moreover, the inner surface of the side shell 16 -- a line -- of course, a projection is also prepared -- it is possible.

[0048]

[Example] Next, the golf club head (an example, example of a comparison) of a wood mold was made as an experiment based on the specification of a table 1, whenever [ reverberation / of a hit ball sound ], the deformation of organic-functions assessment and a head body, a defect incidence rate, etc. were tested, and the engine performance was compared. in addition, a head -- a titanium alloy (Ti-6aluminum-4V) -- carrying out -- a line -- 1.0mm and an arrangement pitch set width of a projection to 1.5mm, and set height to 6mm, and it unified by the arrangement approach of drawing 1 . The test approach is as follows.

[0049] While equipping <reverberation [ of a hit ball sound ] whenever> each sample offering head with the same sh and making the wood mold golf club as an experiment, the hit ball sound of hit ball *Perilla frutescens* (L.) Britton va *crispa* (Thunb.) Decne. was measured [ this crab ] for the installation golf ball (the "Max fly hybrid" by SUMITOMO RUBBER INDUSTRIES, LTD.) in the center section of the face section to the swing robot. Measurement of a hit ball sound was performed by installing the microphone m of the precision sound level meter by Japanese Rion in the location distant from the tow edge of the head at the time of a hit ball 300mm, as shown in drawing 14 . Moreover, in the precision sound level meter, A mold frequency amendment said to be the closest to human being's acoustic sense was performed.

[0050] After changing a hit ball sound into an electrical signal with said precision sound level meter, the output was as the analysis frequency of 0-16kHz, and 2048 samplings, the sampling time was set to about 48ms from the stroke with the FFT analyzer (CF-6400) by Ono Sokki Co., Ltd., and FFT processing and a time-axis sampling were performed (windowing of FFT is carried out in the Hanning window). Moreover, the calibration of the electrical sign in a microphone and an FFT analyzer proofread sound pressure absolutely as equipment by the calibration signal (250Hz and 124dB) in a PISUTO phone (BURYU a well & care company make). Moreover, PWR processing performed the peak frequency of a hit ball sound, and its sound pressure. whenever [ and / reverberation / of a hit ball sound ] -- wavelet analysis software DS-9100 by Ono Sokki Co., Ltd. -- using -- an equivalent for Gabor function: 1/ [ the analysis time frame length 2048 and ] 12 octave, and analytical range 6 octave -- setting up -- the sound pressure of the frequency band 0.04 seconds after the time of a hit ball -- the peak sound pressure of this frequency band -- \*\* -- it asked by things. In order that a reverberation sound may continue greatly and for a long time, a good thing is shown, so that whenever [ this reverberation ] is large. In addition, the decision of a frequency band makes a peak frequency the frequency the sound pressure of 0.04 seconds after indicates maximum to be in 4000-7000Hz.

[0051] Test forming of said golf ball was carried out at each crab by the <organic-functions assessment of hit ball sound> 10 person golfer (handicaps 5-20), five-point full marks estimated the hit ball sound at that time by each golfer's organic functions, and the average showed it. It is so good that a numeric value is large.

[0052] the fixed point of the crown shell of the head body of which <deformation of head body> casting was done, a a SOL shell -- the distance (height) of a between was measured with slide calipers, and the error amount from a design objective value was calculated. An error is so good that a numeric value is small few.

[0053] <Poor casting incidence rate> The absolute value of said deformation of the cast head body used the thing 0.5mm or more as the defective, asked for the incidence rate (average of n= 100), and expressed as the characteristic which sets the example 3 of a comparison to 100. It is so good that a numeric value is small. A test result etc. is show

in a table 1.  
[0054]  
[A table 1]

(共通仕様：ヘッド体積350cm<sup>3</sup>、クラウン殻部の厚さ0.9mm、ソーラ殻部の厚さ1.1mm、サイド殻部の厚さ0.9mm)

	実施例 1	実施例 2	実施例 3	実施例 4	実施例 5	比較例 2	比較例 3	比較例 1
開口部の上下方向の高さ [mm]	50	50	50	50	50	70	70	50
開口部の水平方向の巾 [mm]	100	100	100	100	100	80	110	100
開口部の面積 S [cm <sup>2</sup> ]	39.5	39.5	39.5	39.5	39.5	4.5	7.5	39.5
比〈開口部の面積/フェース面の面積〉	1.0	1.0	1.0	1.0	0.87	1.0	1.0	1.0
補強リブの配置	I 型	II 型	N 型	W 型	II 型	なし	なし	なし
開口部の端縁から補強リブまでの距離 [mm]	0	0	3	0	0	—	—	—
ワックスモデルの製法タイプ	図 5	図 5	図 5	図 4	図 5	—	—	—
補強リブの断面形状及び断面積の合計 [mm <sup>2</sup> ]	長方形 15 30	長方形 30 45	長方形 45	正方形 36	長方形 30	—	—	—
ヘッド内部に補強リブ (有・無)	有り	有り	有り	有り	有り	無し	無し	有り
テスト結果	打球音の残響度	0.85	0.84	0.84	0.83	0.62	0.68	0.83
	打球音の官能評価 (5 点法)	4.3	4.3	4.2	4.3	2.1	2.5	4.1
	ヘッド本体の変形量 [mm]	-0.52	-0.30	-0.04	-0.06	-0.05	-12.35	-5.31
	製造不良発生率 (指数)	16	11	6	8	5	100	82

(共通仕様：ヘッド体積 350 cm<sup>3</sup>、クラウン殻部の厚さ 1.2 mm、ソール殻部の厚さ 1.3 mm、サイド殻部の厚さ 0.9 mm)

	実施例 6	比較例 4	比較例 5
開口部の上下方向の高さ [mm]	50	50	70
開口部の水平方向の巾 [mm]	100	100	110
開口部の面積 S [cm <sup>2</sup> ]	39.5	39.5	7.5
比 (開口部の面積/フェース面の面積)	1.0	1.0	1.0
補強リブの配置	I 型	なし	なし
開口部の端縁から補強リブまでの距離 [mm]	0	—	—
ワックスモデルの製法タイプ	図 5	—	—
補強リブの断面形状及び断面積の合計 [mm <sup>2</sup> ]	長方形 30	—	—
ヘッド内部に補強リブ (有・無)	有り	無し	無し
テスト結果	打球音の残響度	0.86	0.69
	打球音の官能評価 (5点法)	4.4	2.7
	ヘッド本体の変形量 [mm]	-0.05	-3.21
	鑄造不良発生率 (指数)	1.2	100

(共通仕様：ヘッド体積 305 cm<sup>3</sup>、クラウン殻部の厚さ 0.9 mm、ソール殻部の厚さ 0.9 mm、サイド殻部の厚さ 0.9 mm)

	実施例 7	実施例 8	比較例 6
開口部の上下方向の高さ [mm]	45	45	45
開口部の水平方向の巾 [mm]	95	95	95
開口部の面積 S [cm <sup>2</sup> ]	35	35	35
比 (開口部の面積/フェース面の面積)	1.0	1.0	1.0
補強リブの配置	I 型	逆 N 型	—
開口部の端縁から補強リブまでの距離 [mm]	0	0	—
ワックスモデルの製法タイプ	図 4	図 4	—
補強リブの断面形状及び断面積の合計 [mm <sup>2</sup> ]	長方形 15	長方形 45	—
ヘッド内部に補強リブ (有・無)	有り	有り	有り
テスト結果	打球音の残響度	0.81	0.81
	打球音の官能評価 (5点法)	4.0	4.1
	ヘッド本体の変形量 [mm]	-0.69	-0.40
	鑄造不良発生率 (指数)	4.0	35

(共通仕様：ヘッド体積 450 cm<sup>3</sup>、クラウン殻部の厚さ 0.7 mm、ソール殻部の厚さ 1.0 mm、サイド殻部の厚さ 0.8 mm)

		実施例 9	実施例 10	比較例 7
開口部の上下方向の高さ [mm]		70	70	70
開口部の水平方向の巾 [mm]		110	80	110
開口部の面積 S [cm <sup>2</sup> ]		75	45	75
比 (開口部の面積 / フェース面の面積)		1.0	0.65	1.0
補強リブの配置		W型	II型	—
開口部の端縁から 補強リブまでの距離 [mm]		0	0	—
ワックスモデルの製法タイプ		図 5	図 5	—
補強リブの断面形状及び 断面積の合計 [mm <sup>2</sup> ]		長方形 60	長方形 30	— —
ヘッド内部に補強リブ (有・無)		有り	有り	無し
テスト 結果	打球音の残響度	0.84	0.83	0.69
	打球音の官能評価 (5点法)	4.2	4.1	2.6
	ヘッド本体の変形量 [mm]	-0.45	-0.28	-2.231
	鋳造不良発生率 (指数)	32	41	100

[0055] As a result of the test, compared with the example of a comparison, whenever [ reverberation ] is large and, a for the thing of an example, the good result was obtained also in the feeling. Moreover, it has checked that the deformation of a head body was small excellent also in dimensional stability.

[0056]

[Effect of the Invention] two or more lines extended with the golf club head of this invention to a head body and the sense which upheaves from this inner surface to the inner surface of the crown section, or the inner surface of the SO section, and carries out an abbreviation rectangular cross with the face section more preferably as mentioned above - since the projection is formed -- this -- a line -- make the compressional wave of the air produced in the hollow department produce resonance and interference positively, and a projection is echoed for a long time, makes it go across a reverberation sound at the time of a hit ball, and gets. Thereby, a hit ball sound improves. Moreover, since it has the excision marks which excised at least one reinforcing rib which stretches between the inner surfaces of a head body and prevents deformation of this opening, or this reinforcing rib near the opening of a head body, deformation a head body can be controlled.

[0057] Moreover, a head body consists of a cast and forms mold on the occasion of casting using this head body and the wax model of isomorphism. under the present circumstances, a wax model -- a line -- since the part equivalent to projection or a reinforcing rib is formed, the rigidity of the wax model itself is raised and the deformation after shaping of this wax model can be reduced. Therefore, mold with a high precision can be formed, as a result the dimensional stability of a head body may be improved.

[0058] Moreover, dimensional stability can be more effectively improved by applying this invention to the head which is easy to deform the thickness of a crown shell thru/or a SOL shell by smallness like invention according to claim 3

[0059] moreover, invention claim 4 thru/or given in five -- like -- a line -- when whole projection product, adjacent length, etc. are limited to the fixed range, resonance is produced more effectively and a hit ball sound, such as prolonging a reverberation sound, can be improved still more comfortably.

[0060] moreover, the wax model which fabricates the wax model for casting a head body like invention according to claim 6 -- a line -- by preparing the projection model and the reinforcing rib model, the rigidity of the wax model itself is raised effectively and the deformation of the wax model after shaping is reduced. Therefore, the head body which could form mold with few errors to the design-objective value, as a result was excellent in dimensional stability can cast.

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[Translation done.]

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